

Basic power electronics in energy systems

Subject area: Electrical Engineering

University: DTU
Level: BA3, BA4, MA1
Teaching mode: course is developed for fully online participation with the option for a 3 days "summer camp" on campus for the lab exercises as well as group work
Instructor(s): Arnold Knott

Short description

Overview of power electronics Passiv components: capacitors and inductors Signals: RMS value and average value Active components: diodes and MOSETs as switches Rectifier circuits Nonisolated converters: buck, boost and buck-boost converters, supporting circuits, Isolated converters: flyback and forward, single phase transformers, Single- and 3-phase PWM inverters and rectifiers, PWM, 3-phase V/Hz control of AC machines, Switch mode drives and audio amplifiers, feedback systems

Full description

<https://kurser.dtu.dk/course/34620>

Learning outcomes

A student who has met the objectives of the course will be able to:

- describe and calculate the concepts of efficiency, mean value and power factor
- classify converter types and pulse-width modulation
- explain crucial properties of passive and active components in relation to power converters
- determine the time course of voltages and currents for the basic converter topologies (buck, boost and buck-boost) and derivatives thereof
- derive the transfer function for both the basic topologies and derivatives thereof
- determine basic parameters in power electronics circuits based on simulations
- design transformers in galvanically separated topologies (f.x. forward, flyback, push-pull, half-bridge, full-bridge)
- determine basic parameters in switch mode circuits based on measurements on these
- calculate signals and power losses in switch-mode power circuits
- specify power converters and their components using English technical language
- clarify the operation of single-phase and three-phase pulse-width modulated inverters and pulse-width modulated rectifiers
- explain crucial features of V / Hz control of three-phase AC machines and frequency converters

Recommended in particular for students of the following study programmes

electrical engineering, energy, sustainability, space, renewable energy

General information

Contact hours per week:	about 4
Total workload:	150 (in student hours for the whole course)
ECTS credits:	5
Language:	English
Course start date:	02 February 2023
Course end date:	04 May 2023
Add. info about start date:	
Weekly teaching day/time:	scheduled Thursday afternoon - but many learning activities can be scheduled flexible
Time zone:	CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)
Further information:	the course is fully developed for online participation and online support. Support in English, Danish & German is available
Prerequisites:	Ohms law and Kirchhoffs rules applied to alternating current circuits
Activities and methods:	Group work, Lab-work, Self-study, Exercises, Tutorial sessions
Presence on campus:	about 3 days for lab exercises

Final examination

Form:	homework and assignments along the way
Date:	
Location/format:	about 5 times homework hand in and about 4 lab reports
Re-sit possibility:	no
Transcript available:	end of semester
Add. info/requirements:	

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places:	40
Minimum participants:	5
Internal course code:	34620
Contact:	knott@dtu.dk

This course is part of the EuroTeQ Engineering University joint course catalogue 2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.